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Enhancing Children's Understanding of Geometric Shapes Through Realia Media

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Abstract
Based on the results of initial observations at UPTD SPF PAUD, there are still some children who are mistaken in pronouncing and differentiating each geometric shape. This research aims to determine the use of realia media in increasing children aged 5-6 years' understanding of geometric shapes at UPTD SPF Aceh Singkil. The method used in this research is quantitative with the type of Pre-Experimental Design with a One Group Pretest-Posttest Design. The research results showed that the pretest value was 5.21 and the posttest value was 10.57. Based on the results of hypothesis testing using the Paired Sample-t Test technique, the value obtained at sig. (2-tailed) is 0.000 < 0.05, which means Ha is accepted and Ho is rejected. So it can be concluded that realia media increases the understanding of children aged 5-6 regarding geometric shapes at UPTD SPF PAUD Aceh Singkil.

Keywords: *media realia, geometric shapes, Early Childhood*

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Introduction

Early childhood, defined as the developmental stage from birth to six years of age, necessitates various stimuli to foster cognitive, linguistic, physical-motor, socio-emotional, religious-moral, and artistic growth. Among these developmental domains, individual capacity and cognitive advancement includes the fundamental comprehension of geometric shapes, which is critical for young children (A, 2012; Naili S, 2021).

This encompasses their ability to distinguish among different geometric shapes encountered in daily activities and develop skills in assembling geometric forms such as circles, triangles, and squares (Siti K, 2022). The ability to recognize shapes and colors (Akip S dan Zaenal M, 2014; Prahmana & D'Ambrosio, 2020) serves as a foundational skill for early childhood education, facilitating differentiation between geometric forms like triangles, circles, and squares.

Empirical evidence suggests that a significant number of young children struggle to comprehend geometric concepts. This deficiency is influenced by several factors, including heredity, environment, maturity, interest and aptitude, formative experiences, and autonomy. Among these determinants, environmental influence is particularly significant. A stimulating and supportive environment enhances a child's capacity to grasp geometric concepts effectively.

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An initial observation conducted on July 20, 2023, involving children aged 5-6 years, revealed that ten children exhibited confusion when questioned about geometric shapes, misidentified shape names, and faced difficulties in distinguishing among various forms, including circles, triangles, and squares.

In addition, the conventional teaching method provided a structured learning environment that facilitated memorization and classroom order. However, it also posed limitations in fostering active engagement, creativity, and social interaction. While effective for transmitting factual knowledge, this approach may benefit from incorporating elements of interactive and play-based learning to support holistic child development.

Moreover, in terms of social and emotional development, interactions between students were restricted, as the lesson format emphasized individual work rather than collaborative learning. While classroom discipline was well-maintained, some children exhibited passive behavior, relying on the teacher for guidance rather than engaging in self-directed learning. The lack of peer collaboration also limited opportunities for developing communication and teamwork skills.

The process of geometric concept acquisition begins with identifying shapes, exploring structural elements, and distinguishing basic figures such as squares, circles, and triangles. This learning process can be facilitated through play-based activities that encourage children to observe and interact with their surroundings.

In early childhood education settings, the introduction of geometric concepts is often limited to the use of colored paper cutouts, accompanied by storytelling and blackboard illustrations. However, these instructional methods frequently lack interactive play activities that reinforce children's understanding of geometric shapes. According to the Ministry of Education, Culture, Research, and Technology (Kemendikbud, 2022), children aged 5-6 years should be able to recognize, classify, and compare geometric shapes.

Geometric comprehension is a crucial cognitive developmental milestone, as it enables children to encourage visual spatial intelligence, identify, categorize, sequence, and differentiate geometric structures through logical reasoning, derived from real-world environmental stimuli (Yeni T, Arwendis W, 2022).

The ability to recognize geometric shapes also supports logical-mathematical thinking (Jauhari, 2018; Lilik M dan Nur I, 2018). Logical-mathematical reasoning refers to the capacity for rational thought (Ai. S dan Alfian. A, 2022; Ilham S, 2022; Naili S, 2021). This cognitive ability encompasses classification, inference, and calculation (Aisyah I, 2021; Amelia, D.A., 2018).

A child exhibiting logical-mathematical thinking skills can solve basic problems, count, and distinguish between dimensions such as length, height, and size (Rama Y, 2020; Rena N, Edi H, 2021; Siti K, 2022; Yan Y, 2020). To address these challenges, this study proposes the development and implementation of it to enhance children's comprehension of geometric concepts. It refers to unmodified, tangible objects that can be directly presented to children for hands-on interaction, such as circular wall clocks or square picture frames.

As a visual aid in the learning process, it provides direct experiential learning opportunities (Afifah, 2019; Ai. S dan Alfian. A, 2022; Fani K, 2022; P, 2019). The use of realia allows children to maximize their sensory engagement in skill development (Azizah, E. N., Koesmadi, D. P., & Widyaningsih, 2021; Riana Nur Afifah, 2019). Its, as an instructional medium, comprises tangible materials utilized for teaching and is recognized as an authentic teaching tool.

According to Gerlach and Ely, media encompasses all human, material, and event-based elements that create an environment conducive to learning. In this context, teachers, textbooks, and school environments serve as media. Gerlach and Ely classify instructional media into eight categories: real objects, verbal presentations, graphic representations, still images, films, audio recordings, programs, and simulations.

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While realia offer several advantages, including the ability to manipulate and relocate objects in alignment with the thematic instruction (Azizah, E. N., Koesmadi, D. P., & Widyaningsih, 2021; Fani K, 2022; P, 2019; Riana Nur Afifah, 2019), certain limitations must also be acknowledged. Not all instructional content can be represented through tangible objects, and some abstract concepts may require supplementary instructional methods. Additionally, it cannot be fully conveyed through textual descriptions alone, necessitating direct interaction with the objects themselves.

Realia—objects from the real world—offer a vibrant and engaging alternative. This method immerses children in learning by providing tangible experiences that ignite their curiosity and imagination. When educators use it, they create an environment where children can interact with materials that are familiar and relevant to their daily lives (Azizah, E. N., Koesmadi, D. P., & Widyaningsih, 2021; Parirak & Rahardjo, 2022).

This hands-on approach not only enhances receptive language skills but actively promotes expressive language development as children describe, discuss, and explore the objects around them. The utilization of it also encourages social interaction among peers, as children engage in collaborative play and discussions, thereby enriching their learning experiences and developing vital social skills (Parirak & Rahardjo, 2022).

In conventional teaching methods, lessons are typically delivered in a one-way format where the teacher imparts knowledge and students passively receive information. This might involve teachers, reading from textbooks, or using graphics and three dimensional media. While these methods can effectively convey information, they often lead to low levels of student engagement. Children may feel disconnected from the material, limiting their ability to relate concepts to their own experiences (Yuniarti et al., 2023).

In contrast, the realia method promotes active engagement by allowing children to interact with actual objects relevant to the lesson. This hands-on approach captivates children's attention and encourages exploration, observation, and discussion. For instance, if students are learning about fruits, allowing them to touch, smell, and taste real fruits can deepen their understanding and retention of information compared to merely reading about fruits in a textbook (Azizah, E. N., Koesmadi, D. P., & Widyaningsih, 2021; Parirak & Rahardjo, 2022).

Figure 1 The Introduction of Geometric Shapes in Real-World Media

Methodology

The methodology employed in this study is an experimental approach, which is a quantitative research method. Specifically, the research utilizes a *Pre- Experimental Design* with a *One Group Pretest-Posttest Design* (Sidik P, 2021; Sukmadinata, 2005). Experimental research aims to determine the effects resulting from a deliberate intervention implemented by the researcher. This approach is designed to investigate the consequences of specific treatments on subjects within a controlled environment (Abd. Mukhid, 2021; Sudaryono, 2021; Sugiono, 2020).

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Eligibility Criteria

During the process of searching for data through the Google Scholar, Science Direct, Research Gate, Wiley, ERIC, ProQuest, Frontiers, and Web of Science databases, the research must fulfill several inclusion criteria. These criteria include relevance to the study, data sourced from the Science Direct, Mendeley, ERIC, Research Gate and Google Scholar databases, publication within the 2020-2025 period. Based on this search, 28 studies published between 2020 and 2024.

Population and Sample

The population for this study comprises all children in classes B_1 and B_3, each consisting of 27 children, for a total of 81 children aged 5-6 years. The sample selected for the study was class B_2 by random sampling, based from observation analysis as the issue of geometric shape understanding was specifically observed in this class. This class consists of 14 children who were chosen based on the criterion of predominantly experiencing difficulties in understanding geometric shapes.

Statistical Analysis

Data analysis techniques using SPSS version 20 with t-test analysis. The Paired Sample t-Test was selected for this data as it is designed to compare the means of paired samples to determine whether a statistically significant difference exists before and after a given treatment or intervention. By utilizing the same individuals for both measurements, individual differences are controlled, thereby enhancing the accuracy and reliability of the analysis compared to the independent t-test.

Research instruments are tools for systematically collecting data. In this study, the data collection instrument is an observation sheet that involves direct observation. A checklist is marked whenever the observed behavior aligns with the specified categories, ranging from "requires guidance" to "excellent" in terms of the children's understanding of geometric shapes. Therefore, the assessment rubric and criteria used in this study are shown in Tables 1 and 2.

Table 1: Assessment Rubric for Children's Understanding of Geometric Shapes

Learning Objectives	Aspects Developed	Criteria
1. Recognizing Geometric Shapes (triangle, square, and circle)	1. The child is unable to recognize geometric shape	Needs guidance
	2. The child can recognize one geometric shape (triangle, square, or circle) through real-world media with the assistance of the teacher	Adequate
	3. The child can recognize two geometric shapes (triangle, square, or circle) through real-world media around them with the help of the teacher.	Good
	4. The child can independently recognize each geometric shape (triangle, square, and circle) through various real-world media	Excellent
2. Grouping Geometric Shapes (triangle, square, and circle)	1. The child is unable to group geometric shapes.	Needs guidance
	2. The child can begin to group one geometric shape (triangle, square, or circle) through real-world media with the assistance of the teacher	Adequate
	3. The child can group two geometric shapes (triangle, square, or circle) through real-world media around them with the help of the teacher	Good

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Learning Objectives	Aspects Developed	Criteria
	4. The child can independently group each geometric shape (triangle, square, and circle) through various real-world med	Excellent
3. Comparing Geometric Shapes (triangle, square, and circle)	1. The child is unable to compare geometric shapes.	Needs guidance
	2. The child can begin to compare one geometric shape (triangle, square, or circle) through real-world media with the assistance of the teacher.	Adequate
	3. The child can compare two geometric shapes (triangle, square, or circle) through real-world media around them with the help of the teacher.	Good
	4. The child can independently compare each geometric shape (triangle, square, and circle) through various real-world media	Excellent

Table 2: Criteria for Children's Success in Understanding Geometric Shapes

Ability Criteria	Scoring
Need Guidace	0 - 60
Adequate	61 - 70
Good	71 - 80
Excellent	81 - 100

Explaining:
Needs Guidance: The learner participates in remedial activities covering the entire material before progressing to further lessons or studying objectives at a lower level.
Adequate: The learner participates in remedial activities prior to continuing with subsequent lessons, with a focus on aspects that have not yet been mastered.
Good: The learner proceeds to the next stage of learning.
Excellent: The learner advances to the next stage of learning and is involved as a peer tutor or provided with enrichment activities.

The data collection methods utilized in this study are observation and documentation. The observation technique involves the use of an observation sheet designed to monitor and assess the child's development throughout the activities conducted during the study. This tool allows the researcher to systematically record and evaluate the child's progress in real-time.

For data analysis, several statistical tests were employed, including normality testing, homogeneity testing, and hypothesis testing. Normality testing was performed to assess whether the data followed a normal distribution, which is essential for determining the appropriate statistical methods.

Homogeneity testing was conducted to examine the equality of variances across groups, ensuring the assumptions required for further analysis were met. Finally, hypothesis testing was carried out to determine the validity of the research hypotheses, using the statistical software SPSS version 20 to perform these analyses efficiently.

Based on Table 3, the values obtained using the one-sample Kolmogorov-Smirnov test are 0.722 for the pretest and 0.755 for the posttest. According to the normality test criteria, data is considered normally distributed if the significance value (sig.) is greater than 0.05. Therefore, it can be concluded that both the pretest and posttest data are normally distributed.

Based on the SPSS output (Table 4) for the Test of Homogeneity of Variance, the significance value (Sig) is 0.132, which is greater than 0.05. This indicates that the data are homogeneously distributed.

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Table 3 Normality Test

One-Sample Kolmogorov-Smirnov Test

		pre test	post test
N		14	14
Normal Parameters[a, b]	Mean	5.2143	10.5714
	std. Deviation	2.00686	1.22250
Most Extreme Differences	Absolute	.185	.180
	Positive	.185	.180
	Negative	-.135	-.177
Kolmogorov-Smirnov Z		.694	.673
Asymp. Sig. (2-tailed)		**.722**	**.755**

a. Test distribution is Normal
b. Calculated from data

Table 4: Homogeneity Test

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Penilaian	Based on Mean	2.423	1	26	**.132**
	Based on Median	1.685	1	26	.206
	Based on Median and with adjusted df	1.685	1	19.243	.210
	Based on trimmed mean	2.102	1	26	.159

Table 5 Pair Sample t-Test

Pair Sample t-test

		Mean	Std. Deviation	Std error of the mean	95% Confidence Internal of the difference		t	df	Sig.(2-tailed)
					lower	upper			
Pair1	Postest-Pretest	5.35714	1.73580	.46418	4.35434	6.35994	11.541	13	.000

Result and Discussion

Based on the results of the study conducted through five stages—pre-test, treatment I, treatment II, treatment III, and post-test—the activity carried out during the pre-test aimed to assess the children's ability to recognize geometric shapes. This involved activities such as circling geometric shapes according to their form on the children's worksheets and arranging geometric wooden puzzles in groups.

Table 6. Pretest and Posttest Data

Data	Average Scoring	Class
Pretest	5.21	B_2
Posttest	10.57	B_2

The table presents the average scores of Class B_2 in two assessment stages: pretest and posttest. The average pretest score was 5.21, indicating the initial level of students' understanding of the tested geometry. Posttest The average posttest score increased to 10.57, suggesting an improvement in students' comprehension following the intervention or instructional method applied.

The average pre-test score was 5.21, while the post-test score was 10.57. Following this, the researcher conducted a normality test to determine whether the data followed a normal distribution. The hypothesis testing yielded a result of 11.541. The findings of the previous tests showed that the t-value (11.541) was greater than the critical t-value (1.771), thus, the null

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hypothesis (H_o) was rejected and the alternative hypothesis (H_a) was accepted. It can be concluded that the use of it has a positive impact on enhancing children's understanding of geometric shapes at UPTD SPF PAUD Negeri 1 Aceh Singkil.

According to previous research (Ai. S dan Alfian. A, 2022; Fani K, 2022; P, 2019), the use of realia media indirectly helps children to more easily understand and develop their ideas, thereby influencing their learning outcomes.

It, realia is easy to observe, tangible, easily accessible, and directly related to everyday life, which helps capture children's attention and fosters the development of mathematical logical intelligence. Similar studies also indicate that the use of realia media is more effective than interactive media in enhancing children's understanding of geometric shapes (Azizah, E. N., Koesmadi, D. P., & Widyaningsih, 2021).

In addition, Bilal study interpreted brief summary from his research in Turkey about "Children's Geometric Understanding through Digital Activities: The Case of Basic Geometric Shapes" that The data collected through these methods were transcribed and analyzed using content analysis. The findings were then categorized based on Marzano and Kendall's Taxonomy, with a particular emphasis on the initial two levels of cognitive development: retrieval and comprehension.

This approach allowed researchers to evaluate children's ability to recognize and recall geometric shapes throughout the activities (Özçakır et al., 2019). The study identified several gaps in existing research concerning preschool children's understanding of geometric shapes, particularly in the context of digital learning activities.

The key gaps include: (1) *Cultural Context:* Further investigation is needed to explore how cultural and linguistic factors, such as the naming of geometric shapes in Turkish, influence children's conceptual understanding. While the study provides insights into Turkish children's learning processes, it suggests that similar research in diverse cultural settings may reveal variations in cognitive development and conceptualization of geometric shapes. (2) *Diverse Learning Paces*:

Although the study acknowledges differences in the pace at which children grasp geometric concepts, additional research is necessary to examine how personalized learning strategies can effectively support children with varying learning rates and styles. (3) *Longitudinal Studies*: The study primarily focuses on immediate learning outcomes from digital activities. However, there is a gap in understanding the long-term retention and application of geometric concepts acquired through digital platforms.

This highlights the need for longitudinal research to assess the sustained impact of digital learning on children's geometric understanding and overall mathematical development over time. Both studies aim to enhance children's understanding of geometric shapes but differ significantly in their approaches.

The digital activities study focuses on technology's role in education, while the realia media study emphasizes hands-on, tactile learning experiences. Together, they suggest that both digital and concrete experiences can play valuable roles in early childhood mathematics education, providing a multifaceted approach to teaching geometric concepts.

Educational Implications: *Digital Activities Study:* Highlights the increasing significance of integrating technology into early childhood education, advocating for the blend of digital tools with traditional teaching methodologies to enhance *learning outcomes in geometry. Realia Media:* Emphasizes the importance of sensory experiences and the concrete nature of learning, suggesting that utilizing real-life objects can aid children in visualizing and understanding spatial relationships and geometric properties.

Moreover, Tugba stressing the methodology of her research focuses on understanding preschool children's 3D geometric thinking skills and the effects of a specific training program on their development (Öcal & Halmatov, 2016). The key components: *Data Collection Tools*: A semi-structured interview form was used, containing 15 questions with sub-questions aimed

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at assessing six specific abilities related to 3D geometric thinking, based on the framework by Pittalis and Christou (2010).

The tool was developed with input from experts and underwent pilot testing with two children to refine the questions. *Data Analysis:* The collected data were analyzed using descriptive and content analysis methods. Transcriptions of video recordings were coded to identify children's reasoning concerning their answers, with the coding processes being independently verified by two researchers to ensure reliability. Overall, the qualitative design enabled the researchers to gain insight into the children's geometric thinking and the potential.

There are several gaps indicate important areas for future research that could significantly contribute to the field of early childhood mathematics education and enhance the teaching methodologies employed in preschool settings. (1) *Limited Existing Research on 3D Geometry in Early Childhood*: The study indicates that there is a scarcity of research focused specifically on young children's 3D geometric thinking skills and the effectiveness of instructional strategies designed for this age group.

Most existing literature has not adequately addressed how to enhance these specific skills in preschool children. (2) ***Understanding of Volume and Area****:* The findings reveal that young children have a limited grasp of complex concepts such as volume and area, indicating a need for further investigation into effective teaching methods that can better support their understanding of these essential mathematical concepts. (3***) Age Range and Sample Size Limitations***: The study noted limitations in its age range (60 to 72 months) and the small number of participants (seven children).

This restricts the generalizability of the findings, suggesting a need for future research that includes a broader age range and a larger sample size to comprehensively assess the development of 3D geometric skills across different age groups.
(4) Impact of Structured Training Programs: While the study aimed to assess the impact of the "3D in Early Childhood" training program, it notes that further exploration is needed to understand how structured interventions can effectively improve children's geometric thinking skills across various settings and populations

It refers to actual, tangible objects that can be used as teaching materials (Arifin et al., 2023; P, 2019). The characteristics of realia include being original objects in their intact state, being operable in real life, in their actual size, and recognizable as their original form. In terms of category, realia media falls under visual media, meaning it can be seen.

Visual aids in education provide children with direct experiences. Therefore, the use of realia media in learning can be more effective compared to conventional methods in improving understanding, as it is more enjoyable, less monotonous, and increases children's interest in learning, thus making it easier for them to absorb the lessons from the teacher.

The findings of prior research underscore the importance of media as a significant factor influencing children's learning, particularly in mathematical concept understanding (Zikra , rani, 2022; Zikra hayati, Nida Jarmita, Putri Rahmi, 2023; Zikra Hayati, 2019). The introduction of mathematics at an early age is crucial (Hayati, 2021; Ilham S, 2022; Naili S, 2021).

Moreover, other studies emphasize the significant impact of realia media on children's understanding of geometry, confirming that the effectiveness of realia media surpasses that of interactive media in improving geometric shape comprehension in early childhood education (Azizah, E. N., Koesmadi, D. P., & Widyaningsih, 2021; Riana Nur Afifah, 2019).

The importance of media in teaching is highlighted as a tool specifically designed to act as a mediator between students and educators, facilitating a better and more efficient understanding of learning concepts, ensuring that the material is easily and quickly comprehended by children (Diana et al., 2018; Septy Nurfadhillah, 2021). Media is utilized to deliver messages that stimulate children's interest, ideas, and curiosity during learning activities, helping to achieve learning goals (Dewi et al., 2018; Guslinda & Kurnia R, 2018; Muhson, 2010).

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It particularly beneficial as it provides children with the maximum opportunity to study or perform tasks in real-world situations, allowing them to practice their skills using their sensory tools (P, 2019). Another advantage of realia media is that it gives children direct experiences and helps teachers clarify the actual meanings of abstract terms, as realia media is tangible (Azizah, E. N., Koesmadi, D. P., & Widyaningsih, 2021).

The Tugba study highlights the significance of introducing geometry to young children, with a particular focus on the development of three-dimensional geometric thinking. The rationale for teaching geometry is closely aligned with the study's findings and discussions. The research highlights that early experiences in mathematics have long-term effects on children's future learning and achievement.

It underscores the notion that geometry not only lays a foundation for mathematical concepts but is essential for understanding relationships between objects in the real world, aligning with the study's focus on developing children's 3D geometric thinking (Crompton & Ferguson, 2024; Mora Aristega et al., 2023; Öcal & Halmatov, 2016). Moreover, The authors discuss that geometry helps children understand and interpret their physical surroundings, highlighting the necessity of such concepts in daily life.

This connection reinforces the argument for integrating geometry into early childhood curricula to aid children in making sense of their environment (Öcal & Halmatov, 2016). The methodology involved hands-on practices, such as using unit cubes and blocks, which encouraged exploratory learning and creativity. The study suggests that such activities can help children engage with geometric concepts in a playful manner, thereby enhancing their imaginative and creative skills (Adriano et al., 2024; Mohamed & Kandeel, 2023; Özçakır et al., 2019; Saining et al., 2025; Trifunović et al., 2024).

This study proposes a targeted teaching approach that educators in Early Childhood Education (PAUD) can effectively apply. The practical it objects representing geometric shapes—within the classroom. Below are the key steps and media for using: selected suitable realia, encourage children to interact with these objects through practical exercises**: Shape** Hunts: Guide children in identifying geometric shapes in their surroundings. Sorting Games: Allow them to group objects based on their shapes, reinforcing recognition and classification skills. Creative Tasks: Enable children to construct or arrange shapes using physical materials, such as building with blocks or incorporating shapes into artwork.

In conclusion, the findings of this study confirm that it positively influences the learning process in the classroom, making teaching more effective. It stimulates children's thinking by providing direct experiences that align with their real-world experiences. Therefore, this research demonstrates that the use of it significantly impacts children's ability to recognize geometric shapes at UPTD SPF. This is evidenced by the higher post-test scores, which were achieved with the use of its compared to the pre-test scores.

Based on these findings, early childhood education (PAUD) teachers are encouraged to integrate its media into the basic curriculum to enhance young learners' conceptual understanding, engagement, and problem-solving skills. By incorporating exploratory, hands-on activities, teachers can create a more interactive and meaningful learning experience, fostering a deeper comprehension of mathematical concepts through real-world applications. Additionally, further research and professional development programs may be beneficial to support educators in effectively implementing it instructional strategies.

Conclusion

Based on the results of hypothesis testing using the Paired Sample t-Test, the significance value (sig. 2-tailed) obtained was 0.000, which is less than 0.05. This indicates that the alternative hypothesis (H_a) is accepted, and the null hypothesis (H_o) is rejected. Therefore, it can be concluded that the use of realia media has a significant impact on enhancing the understanding of geometric shapes among children aged 5-6 years at UPTD SPF PAUD Aceh Singkil.

Educators in Early Childhood Education (PAUD) should incorporate realia as an instructional tool in geometry education to provide young learners with concrete, hands-on experiences that enhance their understanding of geometric concepts. By utilizing real-life objects that represent various shapes, teachers can bridge the gap between abstract mathematical ideas and tangible experiences, fostering deeper comprehension and engagement in early childhood learning environments.

Future research should investigate the effectiveness of realia-based instructional methods across various age groups to determine their developmental appropriateness and impact on learning outcomes. Additionally, comparative studies between realia and digital media could provide valuable insights into their respective advantages, limitations, and potential synergies in supporting early childhood geometric understanding. Such research could inform best practices for integrating tangible and digital learning resources in early childhood education.

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